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TYPIFICATION OF *SOLIDAGO GRACILLMA* (ASTERACEAE: ASTEREAE) AND APPLICATION OF THE NAME

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ABSTRACT

Variations in application of the name *Solidago gracillima* have compounded confusion over what to include in synonymy under the name. It is regarded here as a species distinct from all those previously included in its synonymy. The holotype shows a diagnostically large inflorescence a few long branches; probable isotypes are variants with smaller, compact inflorescences without elongated lower branches. Morphological features of *S. gracillima* are discussed and compared with other species in *Solidago* subsect. *Maritimae*.

KEY WORDS: *Solidago gracillima*, *Solidago austrina*, *Solidago stricta*, *Solidago* subsect. *Maritimae*

Solidago gracillima Torr. & A. Gray is a goldenrod species native to the outer edge of the piedmount and the Fall Line counties of South Carolina, Georgia, Florida, and possibly North Carolina. It is a member of *Solidago* subsect. *Maritimae* (Torr. & A. Gray) G.L. Nesom, a group of bog., marsh, and seasonally wetland goldenrods with lower stem and basal rosette leaves that have petioles sheathing the stem (Semple & Cook 2006). It has been treated as a relatively narrowly defined species distinct from *S. stricta* Ait. and *S. austrina* Small (Small 1903; Cronquist 1968), as a weakly distinct species "perhaps not specifically distinct" from *S. stricta*" (Radford et al. 1968), as a broadly defined species including *S. austrina* and *S. simulans* Fern. (Jones & Coile 1988) and *S. perlonga* Fern. (Cronquist 1980), or as a subspecies within *S. stricta* Ait. (Semple & Cook 2006, including *S. austrina* Small). The confusion is the result of 1) a lack of understanding about inflorescence variation in subsect. *Maritimae*, 2) how many species should be recognized within subsect. *Maritimae*, and 3) how best to distinguish the species that are recognized with the subsection.

Solidago gracillima Torr. & A. Gray, Fl. N. Amer. 2(2): 215. 1842. *Solidago stricta* Ait. subsp. *gracillima* (Torr. & Gray) Semple, Sida 20: 1615. 2003. **TYPE: USA. Florida.** "Middle," *Dr. Chapman s.n.* (holotype: NY!, Fig. 1; probable isotypes: KEW 2 sheets!, NY 3 sheets!).

The holotype, as recognized here, may be the only collection at NY seen by Torrey and Gray and is the only specimen marked "S. gracillima n. sp." on a Torr. & Gray, Flora N. Amer. label. It also is the only one with an original, printed annotation of "Syn. Fl. N. Amer." Several other probable duplicates of this collection are now at NY but were originally at Columbia College Herbarium (Fig. 2), Hamilton College Herbarium (Fig. 3), and Columbia University Herbarium (Fig. 4). The latter (as well as the holotype) is annotated as "Solidago gracillima TYPE K.M." (K. MacKenzie).

The exact collection locality in Florida is not indicated on any of the *Chapman s.n.* specimens. The species occurs in Panhandle Florida. The Atlas of Florida Vascular Plants (Wunderlin & Hansen 2012) reports collections from Bay, Franklin, Leon, and Wakulla counties, but only collections from Leon County have been seen from Florida by the author.

Figure 1. Holotype of *Solidago gracillima* Torr. & A. Gray, *Chapman s.n.* (NY).

Figure 2. Probable isotype of *Solidago gracillima, Chapman s.n.* (NY ex Columbia College Herb.).

Figure 3. Probable isotype of *Solidago gracillima, Chapman s.n.* (NY ex Hamilton College Herb.).

Figure 4. Probable isotype of *Solidago gracillima, Chapman s.n.* (NY ex Herb. Columbia University).

Type material of *Solidago gracillima* (*Chapman s.n.* NY, Florida) includes large inflorescences that are very open with a few long branches (holotype NY, Fig. 1; isotype NY, Fig. 2) and smaller compact inflorescences without elongated lower branches (isotypes NY, Figs. 3-4). The same individual can produce different shoots with either large or small inflorescences. Terminal and elongated lateral branches have secund heads on distally arching stems. In comparison, inflorescences of *S. stricta* are elongate and narrow with short usually ascending branches (Fig. 5B). The apex is erect and not secund, unless the entire stem is arching as the infloresence develops. Then, the entire inflorescence may be one-sided with branches growing upward in the same direction. If the secund inflorescence of *S. gracillima* is pressed and dried so that the arching is flatted out, then a small inflorescence could be easily confused as that of *S. stricta*. Inflorescences of *S. austrina* when large have ascending spreading elongated lower branches (Fig. 5A); the apex is often slightly secund. Small inflorescences can be like those of *S. stricta*. Inflorescences of *S. perlonga* are similar to *S. austrina*, but the lower elongated branches are longer and more widely spaced on the stem (Fig. 5C). Smaller inflorescences even on the same clone can be similar to those *S. stricta* (Fig. 5C).

Other species in the subsection have slightly different to obviously different inflorescences. Those of *Solidago uliginosa* (Fig. 5D) have short ascending branches and are club-shaped but can be similar to those of *S. simulans* (Fig. 5E) or even *S. austrina*. Inflorescences of *S. mexicana* (Fig. 5F) and *S. sempervirens* (Fig.. 5G) are more secund-pyramidal in general shape. Those of *S. mexicana* have small stem leaves near and into the inflorescence, while those of *S. sempervirens* usually have large leaves just below and into the inflorescence. Those of *S. mexicana* can be similar to *S. stricta*, if the secund aspect to the apex is not strongly developed. In all species, size of the inflorescence is critical in determining branching pattern. Strong apical dominance requires lower branches to be relatively distant before the lower branches can elongate into diagnostic patterns. The tendency for botanists to collect specimens that fit on herbarium sheets, i.e., mid to small individual shoots, has resulted in numerous specimens with small inflorescences with non-diagnostic features. This has led to many misidentifications and repeated errors in the literature about the distribution of individual species. Work is underway to accurately map the distributions of all species in the subsection.

Rosette leaves and lower stem leaves of *Solidago gracillima* are shallowly serrate distally or along much of the margin (Fig. 6). The holotype includes several lower stem leaf fragments that are clearly serrate (Fig. 6A). One of the probable isotypes includes a rosette with rounded-spatulate to acute-lanceolate leaves that are long petiolate and serrate distally (Fig 5D). In the field, lower stem leaves can be similar to the acute, lanceolate rosette leaves and these maintain those traits in cultivated transplants (Fig. 6 B-C respectively, *Semple & Semple 11834*). A few herbarium specimens have larger broader rosette leaves, but under cultivation in a growth chamber such leaves are very robust for the species (Fig. 6 E; seedling rosette leaves, *Anderson 25350 FSU*). Basal leaves of *S. austrina* are similarly serrate but usually larger and oblanceolate, based on observations of lower stem and rosette leaves of herbarium specimens from BRIT, FSU, GA, GH, MO, MT, NY, NCU, USCH, and USF (Thiers, continually undated) and field observations of wild plants in North Carolina, South Carolina, Georgia, and Tennessee. Rosette leaves of *S. stricta* are variable in shape from linear oblanceolate to lanceolate to broadly obovate. However, these are never serrate although sometimes crenate.

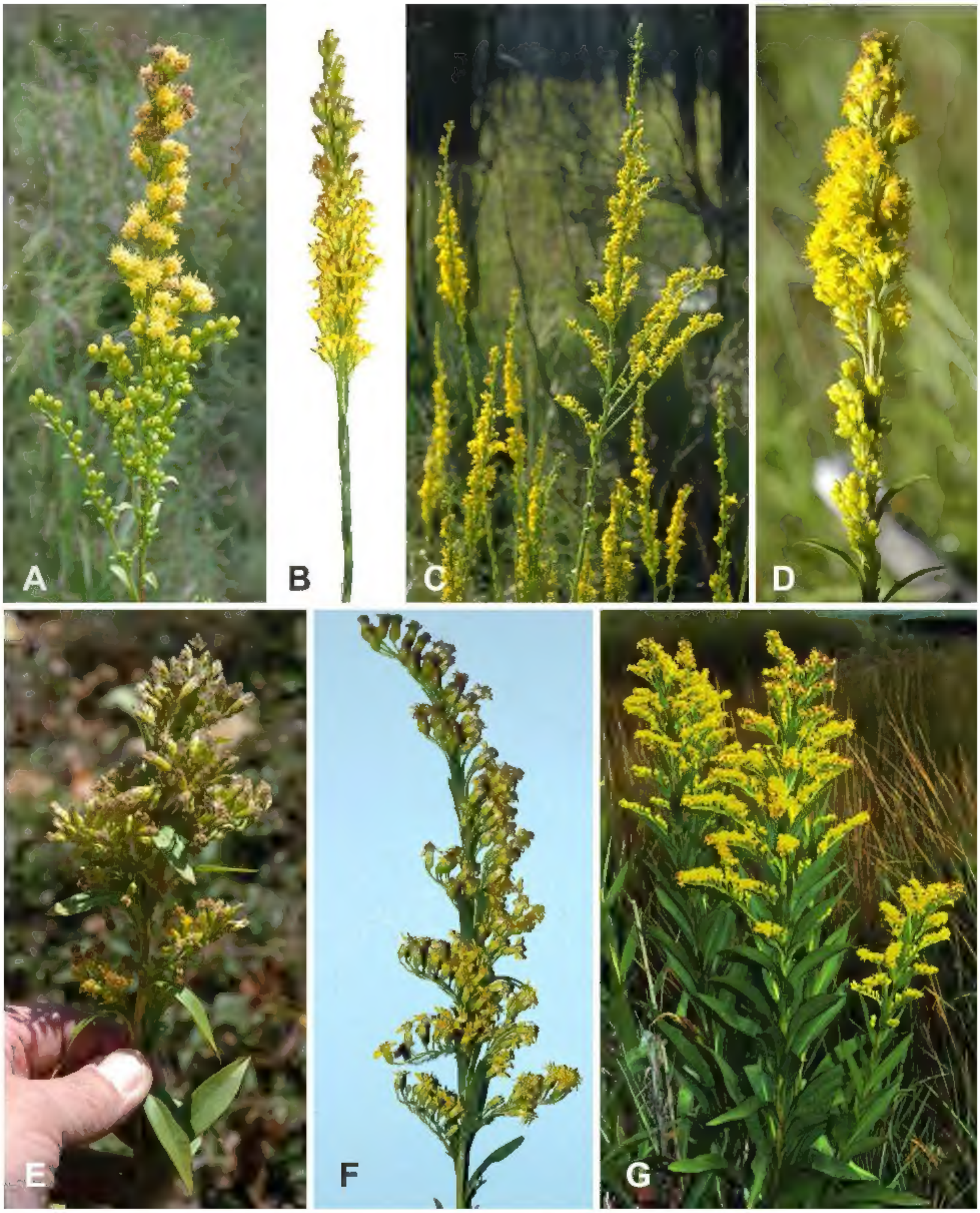

Figure 5. Inflorescence variation in *Solidago* subsect. *Maritimae*. **A.** *S. austrina*, *Semple & Semple 11203*, Alabama. **B.** *S. stricta*, *Semple 11777*, South Carolina. **C.** *S. perlonga*, *Semple 11824*, New Jersey. **D.** *S. uliginosa*, *Semple 11837*, Michgan. **E.** *S. simulans*, *Semple 11588*, North Carolina. **F.** *S. mexicana*, *Semple 11651*, North Carolina. **G.** *S. sempervirens*, Nova Scotia.

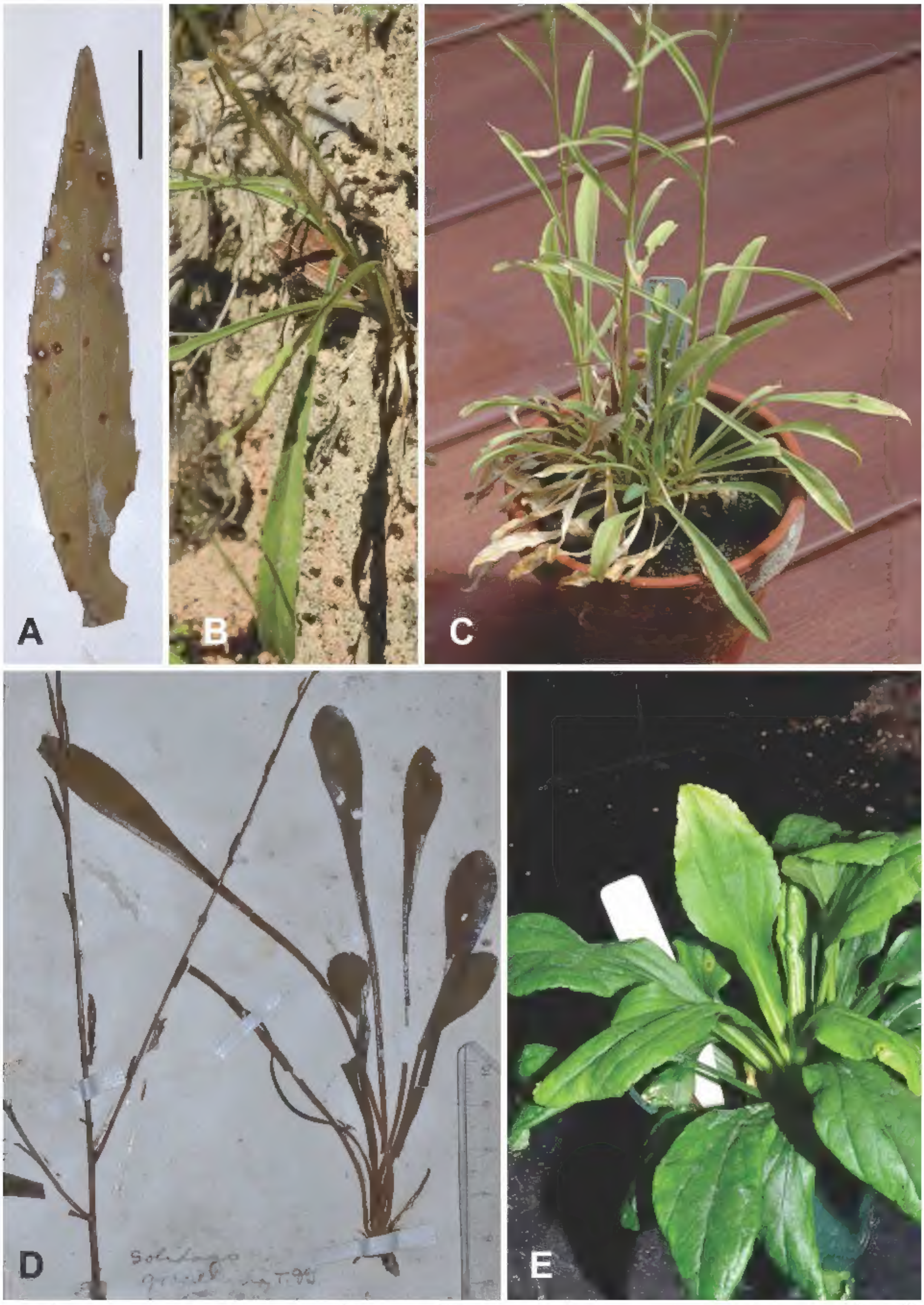

Figure 6. Stem and rosette leaves of *Solidago gracillima*. **A.** Lower stem leaf fragment, holotype (see Fig. 1); scale bar = 1 cm. **B-C.** Lower stem leaves of Semple & Semple 11834. **B.** Wild plant growing out of vertical road embankment. **C.** Cultivated plant grown from rootstock transplanted to WAT. **D.** Basal rosette leaves of isolectotype (see Fig. 2). **E.** Growth chamber grown base rosette of seedling from *Anderson 25350* (FSU).

Wild populations of *Solidago gracillima* have been seen in South Carolina and southwestern Georgia. A small population encountered in Barnwell Co., South Carolina, in 1981 (*Semple & Suripto 9814*) grew at the top of a bank around a shallow pool in a mixed pine and broadleaf woods. Several populations sampled in southwestern Georgia in 2010 were in habitats that could potentially be wetter in the early season, but were dry in early September. *Semple & Semple 11834* (WAT) grew on a sandy clay ridge and on the face of a very steep road cut in an area of mature pine forest and pine plantations (Fig. 7A). *Semple & Semple 11836* (WAT) grew in drier, sandy soil at the top of a roadside ditch, while a few individuals of *S. austrina* grew at the bottom of the ditch in wet sandy and mucky soil (Fig. 7B). All collections of *S. austrina* seen in North Carolina, South Carolina, Georgia, and Tennessee grew in ditches, seeps, wet prairie, and heads of tributaries in usually wetter soils.

Figure 7. Habitats of *Solidago gracillima*. **A.** *Semple & Semple 11834*; SE of Quitman, Brooks Co., Georgia. **B.** *Semple & Semple 11836*; SE of Cairo, Grady Co., Georgia.

Overall, the habitats of *Solidago gracillima* are likely seasonally drier than those of *S. austrina*. Both species can be locally common, but *S. gracillima* is generally less common. I conclude that the tendency to grow in habitats that change from wet to dry over the season is the reason many herbarium collections lack mid and lower stem leaves. The larger leaves become ecologically unsuited to the drier late season conditions and are dropped by the plant. In contrast, most species of subsect. *Maritimae* grow in habitats that are wet to very moist throughout the season. These tend to have lower stem and rosette leaves present at the time of flowering.

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